seen in *Fulgur* and so many other Gasteropods is essentially the same as that which occurs in certain Hirudinea, Gephyreans, Turbellarians, &c., and that which is to be seen in the Lamellibranchs, Annelida, and other aberrant groups can be referred to the same mode; or, in other words, that the Platyhelminths, Annelida, Mollusca, and Molluscoidea have been derived from forms which possessed a typical segmentation similar to that now to be seen in the Pulmonates and many other Gasteropods, many forms in each group, however, having departed from the original mode by reason of subsequent loss or addition of food-yolk. It will follow, as a consequence of this idea, that the regular equal segmentation, which occurs in many forms belonging to these groups, is not primitive, but has been secondarily induced by the conditions under which the eggs segment. The third division of the theoretical considerations will treat of the mesoderm.

The third and fourth portions of the paper will treat respectively of the velum and primitive excretory organs.

The fifth portion will treat of the development of the nervous system. It will be shown that the Lamellibranchs, Pteropods, and Heteropods agree in the formation of their supraœsophageal ganglion with the typical Trochophore larva of *Polygordius*. In the marine Prosobranchs, however, the supraœsophageal ganglia arise as independent local ectodermal thickenings, which have directly nothing to do with a "Scheitelplatte," and which become united with each other and with the pedal ganglia later. Between this arrangement and that of Pteropods &c. the Pulmonates offer an intermediate stage. The problematic cells which have been described by so many authors as lying in the head vesicle, and as derived from the ectoderm, and which were recognized by Wolfson to be a nervous organ in process of degeneration, no doubt represent the apical thickening from which, in the Trochozoon, the Pteropods, &c., the supraœsophageal ganglia are formed. In the Pulmonates the ganglia do not form from these problematic cells, which soon degenerate and disappear, but are formed, as in the marine Prosobranchs, from local proliferations of the ectoderm. There has been an abbreviation of the development in the case of the Pulmonates and Prosobranchs, and it is interesting to note that the latter group presents wide differences from the other Molluscan larvæ in other respects also, *e. g.* the excretory organs. The Prosobranch Veliger seems to be very highly specialized, and affords an excellent instance of larval specialization independent of the specialization of the adult.—*Johns Hopkins University Circulars*, no. 49, May 1886, p. 85.

On the Development and Minute Structure of the Pedunculated Eyes of Branchipus. By Dr. Carl Claus.

The lateral eyes of *Branchipus* possess an increased interest because, like those of the Decapoda and Stomatopoda, they are placed upon movable stalks which have only been developed in the course of the metamorphosis, and give us some authentic information as to the morphological significance of the pedunculated eyes. In a previous memoir* I have already discussed them, and have shown that the movable pedunculated eyes represent the abstricted lateral parts of the head which have become independent. It occurred to me to trace the process of development more in detail, and in this way to ascertain the relations of the so-called eye-ganglion, on the one hand to the cerebrum, and on the other to the retina-ganglion, as also to the elements of the eye itself, and also to work out the hitherto imperfectly-known minute structure of the latter.

The foundation of the lateral eye is perceptible even in meta-nauplius-larvæ, the tissues of which have become clear, as a broad, pad-like, hypodermal thickening placed laterally to the frontal organ. The cell-growth is continued inwards, and here contains the material for the eye-ganglion, which is united with the brain. The pigment first appears in the lateral parts of the eyes, in which, at the same time, the first crystalline cones show themselves as small refringent bodies. The derivatives of the hypodermal cells are there already divided into a superficial layer for the formation of the crystalline cones, and a deeper layer for the nervous rods and pigment, which is continuously connected by trains of fibre-bundles with the cell-mass, which is in course of conversion into the retina- and eye-ganglia. The latter has been produced simultaneously with the foundation of the eye, as a deep-seated layer of the hypodermal swelling, which has been previously indicated by me as the matrix of the eye. This, however, not only effects the greatly increasing extension (with advancing growth) of the eye-segment, which afterwards separates as the pedunculate eye, but at the same time furnishes the material for the increase of the elements of the eye and the retina, as also of the eye-ganglion. The sagittal zone-like hypodermal cushion consequently, to some extent, represents the gemmation-zone both of the eye and of the nerve-mass occurring within the eye-peduncle, the laterally produced cells furnishing the crystalline cones and nervous rods, while the elements which advance inwardly and mesially strengthen the eye-ganglion.

In this nerve-mass in the interior of the eye-peduncle, distinguished as the eye-ganglion, we distinguish two portions, both of which proceed, by continuous growth, from the band-like gemmation-zone, namely, a distal retinal part turned towards the base of the hemisphere of the eye, and a proximal segment united with the cerebrum, the eye-ganglion *sensu strictiori*.

The latter contains a central mass of parenchyma and a superficial coat of ganglion-cells, which appears to be considerably thickened on the anterior surface, and gradually disappears towards the posterior concavely incurvate side.

The fibre-trains of the parenchymatous layer, radiating from the cerebrum, traverse the eye-ganglion transversely in a straight course,

* 'Zur Kenntniss des Baues und der Entwickelung von *Apus cancriformis* und *Branchipus stagnalis*' (Göttingen, 1873).

to enter the parenchymatous layer of the retinal segment through a connective boundary-layer filled with large nuclei; another portion of nerve-fibres originates, however, from the coating of ganglion-cells itself, and crosses the first set of fibre-trains in an oblique direction. In comparison with the eye-ganglion of the Malacostraca, the ganglionic cortex and intercrossing of fibres are very simple, and the parenchymatous mass is not yet, as in them, divided into two or three parenchymatous layers between which the fibre-trains form new internal crossings.

The fibre-crossing in the eye of *Branchipus* therefore only represents the crossing distinguished by Berger as "external" in the eye of the higher Crustacea.

This considerable simplification, which we cannot assume to be due to any secondary reduction, justifies us in starting from the Phyllopod-eye in estimating the two main divisions of the ganglionic apparatus. The first, or proximal part, which, in the eye of the higher Arthropoda undergoes a further division, is the cerebral portion of the eye-ganglion; the distal portion, which is bent almost at right angles to this, and which retains essentially the same structure throughout, is its retinal part, or the retinal ganglion.

This interpretation, already set up by Berger, which at the same time recognizes in the ganglion-cell coat of the proximal eye-ganglion a centre of projection of the second order, is perfectly in accordance with the simplified structural conditions of the eye of *Branchipus*, in opposition to the interpretation of other naturalists who, in the compound eye of the Decapoda and Insecta, do not separate the retinal ganglion distinctly from the eye-ganglion, and regard it as equivalent to the preceding division, but either treat the whole as the retina, or, going to the opposite extreme, refer it to the cerebrum, and regard the nerve-bundles passing to the rods only as the visual nerve-fibres.

The structure of the eye in *Branchipus* is also simpler than in any other pedunculate eye. Above all we have to notice the absence of special pigment cells in the vicinity of the nerve-rods, as also of the crystalline cones. The pigment is deposited rather in the deeper hypodermal cells employed as parts of the sensitive apparatus, in the elements of the nerve-rods around the rhabdoma, and peripherally in the nerve-fibres of the so-called nerve-bundle layer. The rapid movement of the blood takes place in the interstices of the latter, and also in front of the basilar layer in spaces between the attenuated ends of the crystalline bodies. There is no facettation of the cornea, but, as in the eye of *Phronima* (and this is the case also in that of *Apus*), there is a special layer of hypodermal cells above the crystalline bodies. We shall have to regard the presence of this layer of cells as well as the absence of corneal facets and special pigment-cells, and the presence of interstices for the circulation of the blood in the nerve-bundle layer and the layer of crystalline cones, as representing the original form of the Arthropod compound eye, and the appearance of corneal facets by the deficiency of the superficial hypodermal layer as secondary.—*Anzeiger der k. Akad. Wiss. Wien*, March 18, 1886, p. 60.